WHAT IS CLAIMED IS:

1. A method for forming an optical waveguide on a substrate in a process chamber, the method comprising:

depositing an undercladding layer over the substrate;

forming at least one core over the undercladding layer; and

depositing an uppercladding layer over the at least one core with a high-density plasma process.

2. The method recited in claim 1 wherein depositing the uppercladding layer comprises:

flowing an oxygen-containing gas and a silicon-containing gas into the process chamber to produce a gaseous mixture;

generating a high-density plasma from the gaseous mixture; and

depositing a silicate glass layer over the at least one core with the high-density plasma.

3. The method recited in claim 2 wherein a flow rate of the oxygen-containing gas is more than 1.8 times a flow rate of the silicon-containing gas.

4. The method recited in claim 3 wherein the flow rate of the oxygen-containing gas is greater than 175 sccm and the flow rate of the silicon containing gas is between 80 and 110 sccm.

5. The method recited in claim 4 wherein the oxygen-containing gas comprises O_2 and the silicon-containing gas comprises SiH_4.

6. The method recited in claim 2 wherein depositing the uppercladding layer further comprises flowing an inert gas into the process chamber with a flow rate between 0 and 200 sccm.

7. The method recited in claim 2 wherein depositing the uppercladding layer further comprises flowing a fluorine-containing gas into the process chamber with a flow rate between 10 and 20 sccm.

8. The method recited in claim 7 wherein the fluorine-containing gas comprises SiF_4.

9. The method recited in claim 2 wherein depositing the uppercladding layer further comprises flowing a phosphorus-containing gas into the process chamber with a flow rate between 0 and 30 sccm.

10. The method recited in claim 9 wherein the phosphorus-containing gas comprises PH_3.

11. The method recited in claim 2 wherein depositing the uppercladding layer further comprises flowing a boron-containing gas into the process chamber with a flow rate between 0 and 20 sccm.

12. The method recited in claim 11 wherein the boron-containing gas comprises BF_3.

13. The method recited in claim 2 further comprising applying an RF source power to the process chamber, the RF source power having a power density between 6 and 30 W/cm^2.

14. The method recited in claim 2 further comprising applying an RF bias power to the substrate, the RF bias power having a power density between 0 and 16 W/cm^2.

15. The method recited in claim 2 wherein depositing the silicate glass layer comprises depositing the silicate glass layer at a pressure less than 12 mtorr.

16. The method recited in claim 1 wherein depositing the uppercladding layer comprises:

flowing O_2 into the process chamber with a flow rate greater than 175 sccm;

flowing SiH_4 into the process chamber with a flow rate between 80 and 110 sccm such that a ratio of the O_2 flow rate to the SiH_4 flow rate is greater than 1.8;

flowing SiF_4 into the process chamber with a flow rate between 10 and 20 sccm;

flowing Ar into the process chamber with a flow rate between 0 and 200 sccm;

generating a high-density plasma from the gases flowed into the process chamber; and

applying an RF bias power to the substrate, the RF bias power having a power density between 0 and 16 W/cm^2.

17. The method recited in claim 1 wherein forming at least one core over the undercladding layer comprises forming a plurality of cores over the undercladding layer, the method further comprising:

etching a portion of the uppercladding layer in gaps between the plurality of cores; and

depositing a second uppercladding layer over the etched undercladding layer.

18. The method recited in claim 1 wherein the high-density plasma process comprises a high-density plasma electron-cyclotron-resonance process.

19. The method recited in claim 1 further comprising depositing a second uppercladding layer over the uppercladding layer with a plasma-enhanced chemical-vapor deposition process.

20. The method recited in claim 1 wherein the uppercladding layer has a refractive index between about 1.4443 and 1.4473 at a wavelength of 1550 nm.

21. An optical waveguide made according to the method recited in claim 20.

22. An optical waveguide made according to the method recited in claim 1.

23. A method for forming an optical waveguide on a substrate in a process chamber, the method comprising:

depositing an undercladding layer over the substrate;

forming at least one core over the undercladding layer;

depositing an uppercladding layer over the at least one core using a high-density plasma CVD process; and

thereafter, completing formation of the optical waveguide without thermally annealing the uppecladding layer.

24. The method recited in claim 23 wherein the uppercladding layer comprises a fluorinated silicate glass layer.

25. A computer-readable storage medium having a computer-readable program embodied therein for directing operation of a substrate processing system including a process chamber; a plasma generation system; a substrate holder; and a gas delivery system configured to introduce gases into the process chamber, the computer-readable program including instructions for operating the substrate processing system to form an optical waveguide on a substrate disposed in the processing chamber in accordance with the following:

depositing an undercladding layer over the substrate;

forming at least one core over the undercladding layer;

flowing an oxygen-containing gas, a silicon-containing gas, and a fluorine-containing gas into the process chamber to produce a gaseous mixture;

generating a high-density plasma from the gaseous mixture; and

depositing a fluorinated silicate glass uppercladding layer over the at least one core.

26. The computer-readable storage medium recited in claim 25 wherein a flow rate of the oxygen-containing gas is at least 1.8 times as large as a flow rate of the silicon-containing gas.

27. A substrate processing system comprising:

a housing defining a process chamber;

a high-density plasma generating system operatively coupled to the process chamber;

a substrate holder configured to hold a substrate during substrate processing;

a gas-delivery system configured to introduce gases into the process chamber, including sources for a silicon-containing gas, a fluorine-containing gas, and an oxygen-containing gas;

a pressure-control system for maintaining a selected pressure within the process chamber;

a controller for controlling the high-density plasma generating system, the gas-delivery system, and the pressure-control system; and

a memory coupled to the controller, the memory comprising a computer-readable medium having a computer-readable program embodied therein for directing operation of the substrate processing system to form an optical waveguide on a substrate, the computer-readable program including

instructions to deposit an undercladding layer over the substrate;

instructions to form at least one core over the undercladding layer;

instructions to flow a gaseous mixture containing flows of the silicon-containing gas, the fluorine-containing gas, the nitrogen-containing gas, and the oxygen-containing gas;

instructions to generate a high-density plasma from the gaseous mixture and to apply a bias to the substrate; and

instructions to deposit a fluorinated silicate glass layer onto the substrate using the high-density plasma.

28. The substrate processing system recited in claim 27 wherein a flow rate of the oxygen-containing gas is at least 1.8 times as large as a flow rate of the silicon-containing gas.